

Complex Deformation in Eastern Iran: Implications from SAR Interferometric Analysis of the 10 May 1997 Zirkuh $M_w=7.2$ Earthquake

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Collision of the Arabian plate with Eurasia is causing deformation in the Zagros contact zone and also as far as 1000 km away in discrete belts of strain spanning Iran. In easternmost Iran, between about 20° and 34° N, deformation is primarily strike-slip on right-lateral, north-trending faults on both sides of the low, flat Lut block. North of the Lut block, the faults change to left-lateral slip on east-west trends. The 1997 Zirkuh earthquake ruptured the entire 125-km length of the north-south Abiz fault, up to its intersection with the east-west Dasht-e-Bayaz fault. In addition to the 10 May 1997 $M_w=7.2$ Zirkuh event, these two faults have broken in a series of four $M=6$ to 7 earthquakes in the 20th century. The eastern Dasht-e-Bayaz fault cuts the Abiz fault and is very linear through generally low-relief terrain, suggesting nearly pure strike-slip deformation. The Abiz fault and other right-lateral strike-slip faults nearby have curved traces and cut through or along the sides of substantial mountain ranges, consistent with more transpressional strain. Some connect with thrust faults.

Repeat-pass synthetic aperture radar (SAR) interferometry (IntSAR) enables the measurement of surface deformation that occurred in the time between the two SAR passes. In remote areas of Iran, other types of geodetic measurements are not available, so IntSAR provides new information on the upper crustal strain, while the arid climate makes it suitable for the ERS-1 and ERS-2 satellites, despite infrequent coverage. IntSAR analysis of the 1997 Zirkuh earthquake reveals clear fault segmentation along the right-lateral Abiz fault. In the segment transition zones, the co-seismic slip drops dramatically. The southernmost third of the fault was imaged by both ascending and descending ERS scenes, which provides two components of the surface deformation, indicating a substantial thrust slip motion on or beside the southern segment. These interpretations are consistent with field observations of fault offsets and seismic waveform analysis.

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